S. G. BRYER.
Steam Drilling-Machine.

No. 205,998. Patented July 16, 1878.

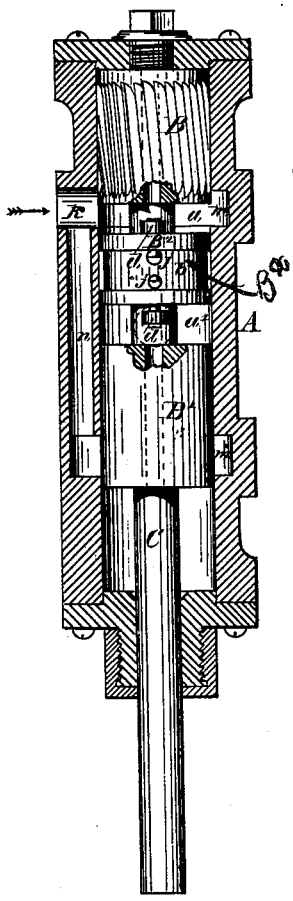

Fig. 1.

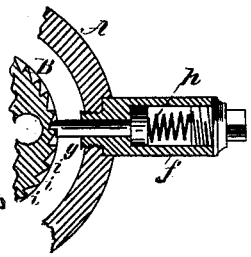

Fig. 4.

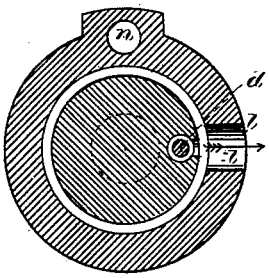

Fig. 3.

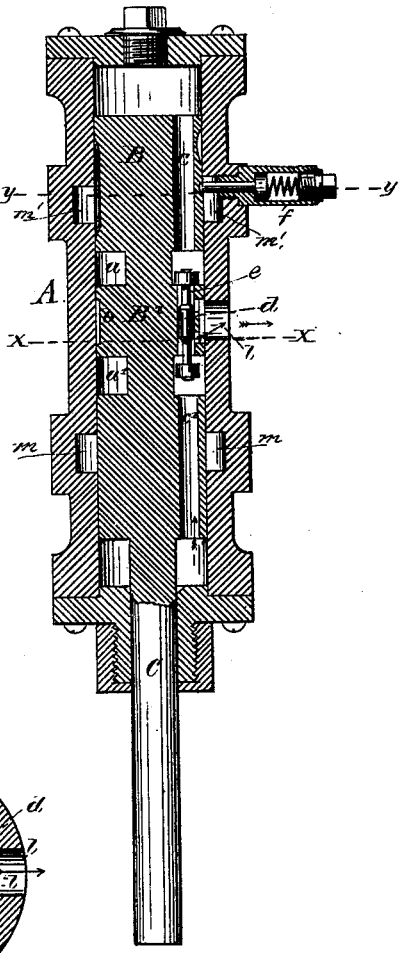

Fig. 2.

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SAMUEL G. BRYER, OF SAUGUS, ASSIGNOR TO HIMSELF AND JOSEPH A. NEWHALL, OF EAST SAUGUS, MASSACHUSETTS.

IMPROVEMENT IN STEAM DRILLING-MACHINES.

Specification forming part of Letters Patent No. **205,998**, dated July 16, 1878; application filed June 21, 1878.

To all whom it may concern:

Be it known that I, SAMUEL G. BRYER, of Saugus, in the county of Essex and State of Massachusetts, have invented Improvements in Steam Drilling-Machines, of which the following is a specification:

My invention relates to improvements in the cylinder and piston, whereby steam or compressed air operates the piston, and whereby the back-pressure of the fluid in the cylinder, which tends to deaden the stroke, escapes through an exhaust; and said invention relates, also, to improvements in the mechanism for rotating the piston, and said improvements are thus described:

The cylinder has two annular grooves, connected by a steam-passage, and said steam-passage opens into one groove, near the inleting-port. The piston is in three parts, separated by two deep annular grooves. The middle part of said piston has a shallow annular groove, and through each of these parts of the piston is a steam-passage, or three passages are arranged all in a line in reference to each other. In the passage of the middle part of said piston is a self-acting valve, the ends of which terminate in the said deep grooves, having heads to prevent them from slipping out and to cover the steam-passage, but leaving the valve loose, so that when the steam-pressure closes the passage at one end by the head of the valve the other end of the passage is open to allow the escape of fluid in the opposite direction, through a hole in the shallow groove, into said steam-passage, and thus out through an exhaust-port. Said shallow groove has two holes opening into the steam-passage, and the self-acting valve fills the passage between the holes, but is smaller toward each end, so as to allow the free escape of fluid through one end and out of one of the holes into the said shallow groove, and thus through the exhaust. The entire circumference of the upper part of said piston, except a portion near each end, is cut by inclined shallow angular or V-shaped notches or grooves, forming a ratchet, into which ratchet a pawl plays to rotate the drill when the machine is in operation.

The object of the improvements invented is to obviate the back-pressure of steam or air in the upward and downward stroke of the piston, and to afford an easy and simple mode of rotating the drill.

I have not thought it worth while to describe any device for feeding the drill to its work, or of supporting the same, whether upon a tripod or column or other support, and therefore I may use any of the well-known devices for these purposes.

In the accompanying drawings, which form a part of this specification, Figure 1 is a vertical section of the cylinder, exhibiting the piston, rod, ratchet, grooves, and self-acting valve and other parts. Fig. 2 is a vertical section of said cylinder in a different part from Fig. 1, and also a vertical section of the piston and rod. Fig. 3 is a cross-section of Fig. 2 on line *x x*, and Fig. 4 is an enlarged section of a part of Fig. 2 on line *y y*.

The letter A represents the cylinder, which cylinder, in practice, runs upon ways or guides, and is fed by any suitable device. B, B^1, and B^2 represent, respectively, the upper part, the lower part, and the middle part of the piston. (Seen in said Figs. 1 and 2.) C is the piston-rod, attached to the piston. *a* represents the upper annular groove, and *a'* the lower annular groove in the piston, and *b* represents a shallow annular groove in the middle part of the piston. *c* is a steam-passage, extending from the groove *a* through the upper part of the piston B. *c'* is a steam-passage through the lower part of the piston B^1 from the groove *a'*. *d* is a self-acting valve, operating in a steam-passage, *e*, in the part B^2 of the piston, and extends from the groove *a* to the groove *a'*; and said valve has caps or heads upon its ends within said grooves, as shown in Figs. 1 and 2. *f* is a cylinder attached to the cylinder A, and contains within it a pawl, *g*, and a spring, *h*. (See Figs. 2 and 4.) *i i*, &c., are angular or V-shaped notches or grooves, spiral or somewhat inclined, as shown in Figs. 1 and 4. *j j* are holes into the steam-passage *e*, opening into the groove in the middle part of the piston B^2. *k* is the induction-port. *l* is the exhaust-port. *m* is an annular

groove in the upper part of the cylinder, and m' is a similar groove in the lower part of the cylinder, and the two grooves are connected by the steam-passage n. (Shown in Figs. 1 and 3.)

I have thus described the outlines of the machine, and will now describe more particularly its object and mode of action.

In this class of inventions the great defect in steam-drills that are valveless is this, namely: In the downward stroke or upward stroke of the piston, when the exhaust-port is closed, the cylinder contains dead steam or air between the cylinder-head and piston, which of necessity offers resistance to the blow, and as the piston approaches the head of the cylinder the resistance becomes greater, or the steam or air is compressed where there is no escape for the dead steam or air, and in this way the blow is weakened or actually stopped, and this is why so many steam-drills of the valveless kind, which would be effective if remedied in this respect, cannot do good work; and hitherto, except in a former invention of my own, so far as I have discovered, no steam-drill of the valveless pattern has been suitably provided with escapes to take off the back-pressure, as I have explained. I will now show the manner in which I have effected this result.

It will be observed in Fig. 1 that the piston is near the head of the cylinder and taking steam through the inleting-orifice k, and that the steam flows into the annular groove a, and then it rushes up through the passage e (see Fig. 2) to the space between the piston and cylinder-head. Its expansion drives the piston downward. As the piston is driven down the dead air or steam in the lower end of the cylinder begins to be compressed, and the steam-pressure against the upper head of the valve d closes the upper end of the passage e, in which the valve lies. The lower end of said passage is then open, and the dead steam or air in the lower end of the cylinder begins to rush up (see Fig. 2) the course of the arrows through the passage c' into the annular groove a', and through the open end of the passage e and the hole j, into the annular groove b, and from that groove through the exhaust-port l. When the steam has driven the piston down so that the shoulder of the part B cuts off the inleting of the steam to the groove a, the steam flows down through the passage n into the groove a', and through the passage c' into the lower end of the cylinder, when the pressure begins to drive the piston upward, and thus drives upward the valve d, when the dead air or steam in the upper end of the cylinder begins to flow down through the passage c into the groove a, and through the upper end of the passage e and hole j into the groove b, and thus out of the exhaust-port l, the one operation being the converse of the other at each stroke of the piston, and in this way the back-pressure is relieved, and the drill in this respect rendered completely effective.

It will be observed that the cylinder has annular grooves m and m', which are connected by the passage n. This allows a free passage of steam in and all around the piston, and the pressure of steam upon the piston is uniform.

If the steam was let in so as to strike against the piston on one side in the upward and downward stroke, it would in a short time so wear the piston and the cylinder that the piston would become loose; but by the steam flowing into the groove m in the cylinder, and through the passage n into the groove m', pressure is alike all around the piston, and there will be no chance for the parts to wear unevenly.

The method of rotating the drill I will now explain. Fig. 1 shows the angular or V-shaped notches i i, &c., which go around the part B of the piston, forming the ratchet; and Fig. 4 gives an enlarged cross-sectional view of a segment of the same, and shows the pawl having a claw upon its end so formed as to fasten upon the ratchet. The pawl is operated in the sleeve f, having a spring, h. At each stroke of the piston the piston is revolved slightly, the pawl running back and forth in the notches or grooves i i, &c., and the ends of the notches are so formed that at each return the clawed pin or pawl slips over into the next groove, and so on. This method of rotating the drill is simple, and the parts are not liable to get out of order.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The cylinder A, provided with the annular grooves m m', connected by the steam-passage n, in combination with the piston, substantially in the manner and for the purpose shown.

2. The arrangement of a steam-passage through the several pistons or parts of the same piston in a cylinder, in one of which passages is a valve so formed that when the pressure of live steam is in one direction the steam-passage in that direction will be closed by the valve, while at the other end of the same passage the dead steam or air at that end of the cylinder will escape into and from said steam-passage through an exhaust in the cylinder, for the purpose shown and described.

3. The piston B^2, having an annular groove, b, in which groove are two holes, j j, opening into a steam-passage, e, through said piston, in combination with the valve d, which valve, pressed in one direction by live steam, is closed at one end and is open at the other end, and whereby the dead steam or air escapes through the open end of the passage

into the groove *b* and through the exhaust *l* in the cylinder, substantially as shown and described.

4. The combination of the ratchet *i i*, &c., formed upon the piston B, and the pawl *g* and the spring *h*, operating in the sleeve *f*, which is attached to the cylinder A, substantially in the manner and for the purpose shown and described.

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